Democratic Errors

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Abstract

In this paper we combine Acemoglu's model of the economic origins of democracy with Lohmann's model of political mass protest. This alllows us to provide an analysis of the economic causes of political regime change based on the microfoundations of rebellion. We are able to derive conditons under which democracy arises peacefully, when it occurs only after a violent rebellion, and when oligarchy persists. We model these posibilities in a world of asymmetric information where information cascades are possible, and where these cascades may involve errors in a paratian sense.

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We thank Van Kolpin for several useful discussons.

1 Introduction

Why are some countries democratic and others not? Why do some countries have stable political institutions and others seem to be in a constant state of flux? And, what role does economics play in determining a country's political institutions and their stability? Obviously these are large, difficult, and important questions. They are also questions on which until comparatively recently economic theory was relatively mute. The existent literature, like this paper, is concerned primarily with the questions of if and how societies will evolve from Oligarchy to Democracy. Two main themes pervade this literature; the first as in Acemoglu et al (1), (2), (3), (4), Conley and Temini (7), Ellis and Fender (8), (9) and Overland et al (15) examines political and economic decisions when a ruling elite face a threat of revolution. Franchise extensions then arise as a means of removing this threat. A second strand of literature, Lizzeri and Persico (10), Llavador and Oxoby (11), involves an elite extending the franchise so as to avoid pareto inferior redistributive policies arising from internal political competition. In these setups franchise extension does not require an external threat of revolution. A common element in both strands of literature is that the extension of the franchise is always peaceful, the threat of rebellion or the existence of superior economic policies under democracy are sufficient to bring it into effect. Clearly there are examples of such peaceful democratic transitions such as Britain in the 19th century, however there are numerous other examples where changes in the franchise only arose after bloody conflict, the French Revolution springs to mind. Indeed why did rational forward looking French aristocrats not foresee the shadow of Madame Guillotine and behave accordingly? In this paper we shall argue that they did, but we shall also contend that in world of asymmetric information there are perfect Bayesian equilibria in which an elite will rationally choose to run the risk of rebellion.

Our approach is to resite the analysis of Acemoglu et al in such an asymmetric information world. In our analysis a rich enfranchised elite observe the state of nature, while the unenfranchised poor only receive a signal imperfectly correlated with this state. The poor may however learn from the actions of the rich and each other. This is precisely the informational environment in which information cascades of the type developed by Banerjee (5), and Bikhchandani, Hirshleifer, and Welch (6) arise. Following Lohmann (12), (13), (14) we use these information cascades to provide a microfoundation for mass political protest and rebellion. Combining this theory of rebellion with the structure developed by Acemoglu allows us to explore the economic origins of political regimes, particularly we can explore how the quality of information available in a society effects the regime choices of a ruling elite. We show, for example, that revolution against an oligarchy is more likely the higher is the quality of information available to the poor, that is open societies tend to become democratic either peacefully or via a rebellion.

2 A Simple Two-Period Model

Rather than launch into the complexities of a fully fledged model we begin with a simple two period version, this both helps to lay out our arguments and to fix notation.

2.1 Economics

We assume a static population of n individuals m of whom are homogeneous poor agents, and $n-m$ are homogeneous rich agents. The poor are more numerous than the rich, $m > n-m$. Each period the agents receive constant endowment incomes y_r,and y_p where subscripts indicate rich and poor respectively; naturally $y_r > y_p$. In addition to endowment incomes the agents may also receive or pay transfers, T_i $i = r, p$, from or to the government. For simplicity we assume these transfers can only take place between the rich and poor, and may take one of two values in per-poor-agent terms, $T_p \in \{0, \overline{T}\}$, so assuming the government must balance its per-period budget the transfer per rich agent must be $T_r \in \{0, -\left(\frac{m}{n-m}\right)\overline{T}\}$. Both groups of agents discount the future at the common rate δ, so the two period indirect utility of an individual agent is written

$$V(y_i \mid T_i(t)) = (1+\delta)\, y_i + \sum_{t=1,2} \delta^{t-1} T_i(t) \;\; i = r, p \tag{1}$$

2.2 Politics

We assume that at the beginning of the first period only the rich are enfranchised, the median voter is a rich agent who thus chooses transfers. At the end of period 1 the poor have the option of staging a rebellion or not. If a rebellion takes place it is successful, the rich are ejected from the country and the poor seize their endowment income from both the first and second periods. A rebellion is destructive and a portion μ of total endowment income is destroyed in both periods. The magnitude of μ is stochastic, taking values of μ^h and μ^l with probabilities $\rho(\mu^j)$ $j = h, l$ respectively. The notation h and l denotes high and low *threat* states, representing states in which there is either little or a great deal of destruction respectively, hence $\mu^l > \mu^h$. The poor do not have the option of rebelling in the second period. Faced with an incipient rebellion the rich have two options, to make transfers, or to extend the franchise to all poor agents. In the latter case where the franchise is extended the median voter becomes a poor agent who then sets transfers for both periods.

2.3 Model Sequence

The sequence of events is as follows. At the beginning of period 1 nature selects μ, the rich then decide whether to extended the franchise, if they do the poor then set transfers for period 1, if they do not the rich set transfers for period 1. At the end of the first period the poor if not enfranchised decide whether or not to rebel. If they do they are successful, the rich are expelled and their endowments seized by the poor. If the franchise is not extended and there is no rebellion then the rich again set transfers in the second period. If the franchise has been extended then the poor set transfers in the second period.

2.4 Informational Assumptions and Equilibria

To the simple structure outlined above we add two further assumptions

1. The following sets of inequalities describe the structure of payoffs

$$\begin{aligned}(1+\delta)\left(y_p + \overline{T}\right) &> (1+\delta)\left(y_p + \left(\frac{n-m}{m}\right) y_r\right)(1-\mu^h) > (1+\delta)\, y_p + \overline{T} \\ &> (1+\delta)\left(y_p + \left(\frac{n-m}{m}\right) y_r\right)(1-\mu^l) > (1+\delta)\, y_p \end{aligned} \tag{2}$$

$$(1+\delta)\, y_r > (1+\delta)\, y_r - \left(\frac{m}{n-m}\right)\overline{T} > (1+\delta)\left[y_r - \left(\frac{m}{n-m}\right)\overline{T}\right] > 0 \tag{3}$$

2. μ is observed by both the rich and poor at the beginning of the first period.

It is now straightforward to characterize the equilibria in this model.

Proposition 1 *(1) If $\mu = \mu^l$ the rich do not extend the franchise, there is no revolution, transfers are $T_p = \overline{T}$ in the first period and $T_p = 0$ in the second. (2) If alternatively $\mu = \mu^h$ the rich extend the franchise, there is no revolution, transfers are $T_p = \overline{T}$ in both periods.*

The proofs of this and all subsequent propositions and lemmas are provided in the appendix.

Proposition 1 is the result previously obtained by Acemoglu et. al. that the rich instigate democracy to make future redistributional promises credible, promises they require to prevent revolution. It is useful to reflect on the implications of this result and why it arises. Notice first that democracy arises because of the off-equilibrium threat of rebellion, the transition to democracy is in this sense peaceful. Notice also that if $\mu = \mu^h$ democracy must occur, whereas if $\mu = \mu^l$ oligarchy persists. In this sense democracy occurs when it "aught" to and never when it "shouldn't", democracy or the lack thereof is never a mistake. The logic behind these results is straightforward, both the rich and the poor know that the poor will successfully rebel whenever it is in their interests to do, that is if the expected value of rebellion exceeds the expected value of oligarchy with transfers, so, once $\mu = \mu^h$ is known rebellion will occur unless the rich can find a way of credibly promising future transfers. Democracy is inevitable. However, suppose we retain the payoff structure of our example but change the informational assumptions, that is

2′. μ is observed by the rich but not the poor at the beginning of the first period.

This immediately changes things considerably, unable to observe μ the poor do not know if they should rebel or not. The rich observe μ but this no longer tells them how the poor will behave. Suppose that the poor receive some imperfect information about the true state, and suppose also they know the equilibrium strategy of the rich, and can thus make any appropriate inferences about the state from observing their behavior (we are deliberately vague here but will make our argument precise later). The rich still face a credibility problem in the second period, so unless they introduce democracy their second period equilibrium strategy must involve $T_p = 0$, however in period 1 their strategy may now be contingent on the state observed and the inferences they know the poor will subsequently make. Let $T_p^i \in \{0, \overline{T}\}$ be the strategy of the rich if the state is $i \in \{h, l\}$ further let the probability that a revolution will occur given the state and the strategy of the rich be written $\beta(i, T_p^i, T_p^{-i})$ for $i \in \{h, l\}$. We assume $\beta(h, T_p^i, T_p^{-i}) > \beta(l, T_p^i, T_p^{-i})$ for $i \in \{h, l\}$, that is all else equal revolution is more likely in the high state.

Proposition 2 *(1) If $1 - \beta(h, \overline{T}, \overline{T}) \geq \frac{(1+\delta)(y_r - \overline{T})}{(1+\delta)y_r - \overline{T}}$ then the equilibrium involves continued oligarchy, transfers are $T_p = \overline{T}$ in the first period and $T_p = 0$ in the second, there is a positive probability of revolution given by $\rho(\mu^h)\beta(h, \overline{T}, \overline{T}) + \rho(\mu^l)\beta(l, \overline{T}, \overline{T})$. With probability $\rho(\mu^l)\beta(l, T_p^i, T_p^{-i})$ revolution will be a mistake in the paretian sense that both rich and poor will be worse off ex-post. With probability $\rho(\mu^h)\left[1 - \beta(h, \overline{T}, \overline{T})\right]$ the poor will fail to rebel when it is in their interests to do so. (2) If $1 - \beta(h, \overline{T}, \overline{T}) < \frac{(1+\delta)(y_r - \overline{T})}{(1+\delta)y_r - \overline{T}}$ the rich will introduce democracy and the equilibrium will be identical to the full information case of proposition 1.*

The intuition behind the proposition isn't too complicated, if the rich know the poor are unlikely to rebel, that is if $1 - \beta(h, \overline{T}, \overline{T})$ is sufficiently small, they are willing to run the risk of rebellion because it allows them to avoid democracy with it's implied second period transfers.

Notice that now both a peaceful transition to democracy and violent rebellion are possible dependent on the informational structure and the probability of rebellion. However, these results are obtained from the simplistic structure of a two period model in which the rich may choose only between two levels of transfers, and where the beliefs and actions of the poor are represented by revolution probabilities that are exogenous. In the sections that follow we generalize this analysis in a number of ways: The number of periods becomes infinite, transfers become a continuous choice variable, poor agents beliefs and actions are formally modeled, consequently revolution probabilities are made endogenous, and revolutions may fail.

3 A More General Model with Endogenous Rebellions

In this general model we carry over all notation and assumptions from the two-period version unless stated otherwise.

3.1 Economics

We continue to assume the government acts in the interests of the median enfranchised voter, however it now has two policy instruments at its disposal, a common distortionary proportionate tax on all incomes, τ, and a common per-person lump-sum transfer T. The distortionary effects of the income tax are given by the increasing convex cost function $C(\tau)$. The government is again assumed to operate a per-period balanced budget, and hence redistributes all net tax revenue back to the population via uniform lump-sum transfers. The government's budget constraint in per-person terms may then be written

$$T = \frac{1}{n}\left(\sum_{i=1}^{n} \tau y_i - C(\tau) n y\right) = (\tau - C(\tau))\, y. \tag{4}$$

where

$$y = \frac{1}{n}(m y_p + (n-m)\, y_r) = (1-\eta)\, y_p + \eta y_r \tag{5}$$

represents average pre-tax income, and where η is the the proportion of the total population that are rich.

There are now an infinite number of periods, in each infinitely lived agents of type $i = r, p$ receive income y_i on which they pay taxes τy_i and receive a transfer T. The single period indirect utility of an individual agent is rewritten

$$F(y_i \mid \tau) = (1-\tau) y_i + (\tau - C(\tau))\, y \tag{6}$$

When appropriate we shall express the indirect utility derived from the discounted infinite stream of income by the form

$$V(y_i \mid \tau) \equiv \frac{F(y_i \mid \tau)}{1-\delta}. \tag{7}$$

3.2 Politics

We assume an initial state in which only the rich are enfranchised. In each period the poor have the option of staging a rebellion or not. If a rebellion takes place, and is successful, the rich are ejected from the country and the poor seize their endowment income in the current and all subsequent periods. A rebellion is destructive and a portion μ of total endowment income is destroyed in perpetuity. The magnitude of μ is stochastic, taking values of μ^h and μ^l with probabilities $\rho(\mu^j)$ $j = h, l$ respectively. As in the simple model the notation h and l denotes high and low *threat* states, representing states in which there is either little or a great deal of destruction respectively, hence again $\mu^l > \mu^h$. Note that we now assume destruction is total in the low state, that is $\mu^l = 1$, this does not qualitatively effect any of our conclusions but helps considerably in simplifying the exposition.

3.3 Information Structure

We assume that the enfranchised are fully informed about the structure of the economy and the realization of the random variable μ. The rich, if present in the economy, are always fully informed. The poor are perfectly informed about the structure of the economy, and also observe μ if enfranchised, but if unenfranchised they each receive an idiosyncratic signal s^i concerning the realization of μ. The probability that the signal received by any poor agent is accurate is given by

$$\rho(\mu^j \mid s^j) > \frac{1}{2} \; j = h, l. \tag{8}$$

The signal received by each poor agent is private information, unobservable to all other agents in the economy both rich and poor.

3.3.1 The Beliefs of the Poor

The beliefs of each poor agent are the probabilities they attach to the two states conditional on all information available to them. This information will include; their own signals, any inferences they are able to make about the signals received by other poor agents, and any inferences they may be able to make through observing the actions of the rich.

Condition 3 *The beliefs of the poor are* consistent *in that (i) they are not inconsistent with the known structure of the model, (ii) they are not inconsistent with the observed behavior of the rich or of other poor agents.*

This condition on the consistency of beliefs is essentially the assumption that expectations are rational and helps greatly in reducing the number of potential equilibria by eliminating candidate equilibria supported by "strange" off-equilibrium beliefs.

3.4 The Decisions of the Rich and Poor

3.4.1 The Rich

The rich initially control the government as they are the only agents enfranchised. If the rich do not enfranchise the poor they set taxes and transfers; provided there is no subsequent revolution the players per-period payoffs are

$$F(y_i \mid \tau_r) = (1 - \tau_r)y_i + (\tau_r - C(\tau_r))\, y \; i = r, p. \tag{9}$$

However, the rich may choose to enfranchise the poor. In this case since the poor are the more numerous, the median voter is one of their number, and their preferences determine taxes and transfers.[1]

3.4.2 The Poor

If enfranchised the poor set taxes and hence transfers and the players per-period payoffs are

$$F(y_i \mid \tau_p) = (1 - \tau_p)y_i + (\tau_p - C(\tau_p))\, y \; i = r, p. \tag{10}$$

If unenfranchised each poor agent may choose between accepting the tax/transfer pair offered by the rich or engage in a "revolutionary act", this act is costless, but only leads to a successful rebellion in circumstances to be defined below. We define $\beta(\mu^j \mid \tau)$ as the probability that a revolution will be successful in state $j = h, l$ given the tax rate τ. As we shall shortly see $\beta(\mu^j \mid \tau)$ is decreasing in the tax rate as this increases the number of poor agents that need to undertake a revolutionary act before a revolution is successful. After a successful revolution the players per-period payoffs are

$$F(y_r \mid 0) = 0, \tag{11}$$

and

$$F(y_p \mid 0) = y(1 - \mu^j)\frac{n}{m}. \tag{12}$$

We now state a useful lemma.

Lemma 4 $\frac{\partial F(y_r|\tau_p,n)}{\partial \tau_p} < 0$, *the per-period payoffs of the rich are monotonically decreasing in the tax rate.* $\frac{\partial F(y_p|\tau_p,n)}{\partial \tau_p}$ R 0 *as* τ_p Q τ_p^d *the per-period payoffs of the poor have an interior maximum defined by* τ_p^d.

3.5 Structure of the Game

This is a repeated stage game which is solved in the usual manner to obtain the Perfect Bayesian Equilibrium. Beginning in the initial state in which only the rich are enfranchised, in each period the sequence of moves is as follows. Nature moves first and determines the state of the world μ^j $j = h, l$. This is observed by the rich, the poor are not initially enfranchised and do not observe the state.[2] The rich then choose whether or not to extend the franchise to the poor. If the franchise is extended the poor set taxes and transfers. The players receive their stage payoffs and the game then continues with both rich and poor enfranchised in all subsequent periods. If the franchise is

[1] If the rich choose to enfranchise any poor agents they will enfranchise all of them. Their motivation is precisely to make a poor agent the median voter. This, as in Acemoglu, acts as a commitment device for the rich to a set of taxes and transfers they would otherwise be unable to credibly promise.

[2] We introduce no notation to indicate which signal s^i is observed by which poor agent as this plays no role in our subsequent analysis.

not extended then the rich set taxes, poor agents then receive idiosyncratic informative signals s^i on the basis of which each poor agent chooses whether or not to engage in a "revolutionary act". The revolutionary acts will with a given probability (that will be determined shortly) lead to a successful revolution, in this case the players receive their stage payoffs and the game then continues without the rich. If the revolution is unsuccessful the rich and poor receive their stage payoffs and then the game repeats with nature again moving first. The following game tree is illustrative.

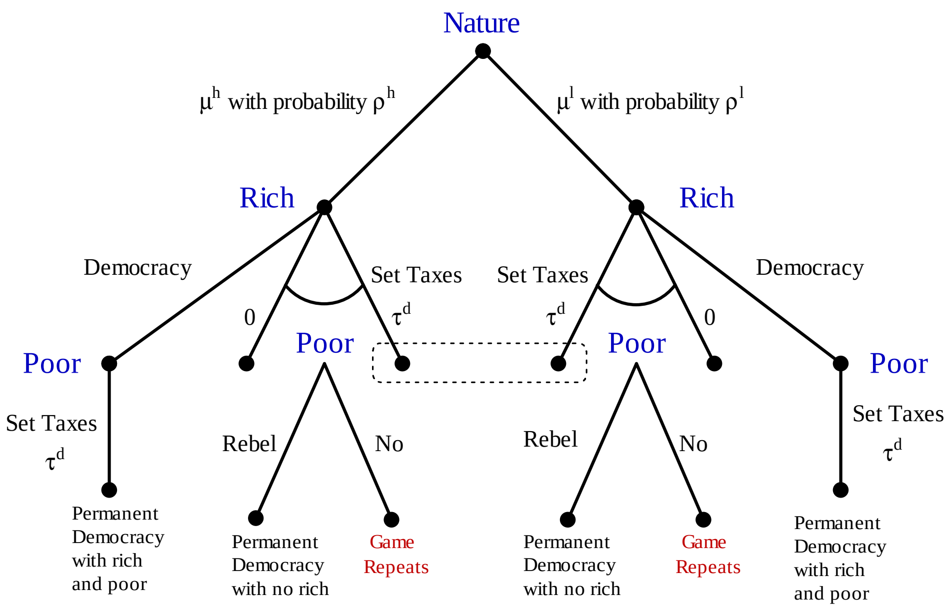

Figure 1: The Game in Extensive Form

One immediate observation is that if the equilibrium involves the rich choosing to set taxes at the same rate for both realizations of the state of the world, then this reveals no information to the poor. However, if the franchise is extended in one state but not the other, or, if different tax rates are set for the two states, then this is immediately revealing to the poor.

3.6 Potential Equilibria

3.6.1 Democracy

There are two potential democratic outcomes to the game, with and without the presence of the rich, dependent on whether the rich peacefully instigate democracy, or, if democracy arises after a revolution during which the rich are expelled. We term these inequitable and equitable democracies respectively. If the rich are present in a democracy the poor set taxes so as to maximize

$$\underset{\tau_p}{Max}\, V(y_p \mid \tau_p) = \frac{F(y_p \mid \tau_p)}{1-\delta} = \frac{(1-\tau_p)y_p + (\tau_p - C(\tau_p))\, y}{1-\delta}. \tag{13}$$

So let

$$\tau_p^d = Arg\max_{\tau_p} V(y_p \mid \tau_p). \tag{14}$$

Then the players payoffs in this case will be

$$V(y_i \mid \tau_p^d) = \frac{(1-\tau_p^d)y_i + \left(\tau_p^d - C(\tau_p^d)\right) y}{1-\delta} \quad i = r, p. \tag{15}$$

We assume that the concession of democracy from the rich to poor is sufficient to prevent a revolution. It is an open question why in a democracy the poor do not vote to expel the rich and seize their endowments[3].

If the rich are not present in a democracy, as occurs after a successful revolution, then the poor do not tax themselves and the payoffs are

$$V(y_p \mid 0, \mu^j) = \frac{F(y_p \mid 0, \mu^j)}{1-\delta} = \frac{y(1-\mu^j)n}{(1-\delta)\,m}, \tag{16}$$

$$V(y_r \mid 0) = 0. \tag{17}$$

3.6.2 Oligarchy

If the franchise is not extended to the poor, then a rich agent is the median voter and taxes maximize their payoffs. Recall that given the state and the tax rate there is a probability of successful rebellion given by $\beta(\mu^j \mid \tau)$ which at this point we simply assert is non-increasing in τ, we shall establish this formally in section 5 that follows. Further we shall also show that $\beta(\mu^h \mid \tau) \geq \beta(\mu^l \mid \tau)$ for any given τ. With these two facts in hand we may state the logic of the oligarchy case.

As a first step to determining the taxes set by the rich we state the following.

Proposition 5 *Taxes under oligarchy cannot be fully revealing of the state.*

Recall that we require the beliefs of the poor to be consistent in the sense of condition 3. Suppose first that a low tax were set in the low state and a high tax in the high state. Suppose further that consistent with these taxes the poor believed with probability one that the state is high if they observe the high tax rate and low when they observe the low one. We know from lemma 4 that the payoffs of the rich are monotonically decreasing in the tax rate, hence the rich would set the low tax in both states contradicting taxes being revealing. An immediate corollary to proposition 5 is the following

Corollary 6 *In a pure strategy equilibrium in which the beliefs of the poor are consistent the rich cannot set state contingent tax rates.*

[3]It might well be that if there were a continuum of endowment levels rather than just rich and poor, then no type would be willing to vote to expel types more afluent than themselves as this would lead to their being expelled next.

Here the argument is immediate, were the rich to set state contingent taxes then these would be revealing but proposition 4 rules this out in equilibrium. Hence in oligarchy the rich must choose a single tax rate for both states. Qualitatively there are two tax rates that can be chosen, an intermediate rate that admits a positive probability of rebellion in both states, and a high tax rate that prevents rebellion in both states. The option of a very low tax rate is clearly never optimal for the rich, further the rich would never choose a tax rate above that necessary to avoid rebellion in the high state, so define as $\underline{\tau}$ the tax rate that in a world of certainty would just avoid rebellion in the low state and $\overline{\tau}$ as the equivalent tax rate for the high state, hence these tax rates satisfy

$$\frac{(1-\overline{\tau})y_p + (\overline{\tau} - C(\overline{\tau}))\, y}{1-\delta} = \frac{y(1-\mu^h)n}{(1-\delta)\, m}, \tag{18}$$

and

$$\frac{(1-\underline{\tau})y_p + (\underline{\tau} - C(\underline{\tau}))\, y}{1-\delta} = \frac{y(1-\mu^l)n}{(1-\delta)\, m}, \tag{19}$$

then we know that $\tau \in [\underline{\tau}, \overline{\tau}]$.

Secure Oligarchy A secure oligarchic equilibrium involves the rich choosing $\tau = \overline{\tau}$ for both realization of μ^j, and beliefs by the poor such that the tax rate chosen is optimal. Suppose that the beliefs of the poor are $\rho(\mu^j \mid \tau \in [\underline{\tau}, \overline{\tau})) = \rho(\mu^j)\ j = h, l$, that is the off-equilibrium beliefs of the poor are their beliefs prior to observing the tax rate. Suppose further that $V(y_r \mid \overline{\tau}, \mu^l, \rho(\mu^l)) \geq V(y_r \mid \tau, \mu^l, \rho(\mu^l))\ \forall\ \tau \in [\underline{\tau}, \overline{\tau})$, where we include $\rho(\mu^l)$ in the payoff function of the rich to indicate the beliefs of the poor. This specifies an equilibrium in terms of strategies for the rich and beliefs for the poor[4]. The intuition for this equilibrium is straightforward, the poor believe that whatever tax rate they observe set by the rich that this conveys no information concerning the state of the world. The rich cannot change the beliefs of the poor via manipulations of the tax rate, and the solution to the rich's optimization problem is the corner solution $\tau = \overline{\tau}$.

Insecure Oligarchy In an insecure oligarchy the rich set a single tax rate which admits the possibility of rebellion, but from which, given the beliefs of the poor, they will not wish to deviate in either state. We already know that taxes cannot be state contingent. It follows that an insecure oligarchic equilibrium involves a single tax rate $\tau \in [\underline{\tau}, \overline{\tau})$, and consistent beliefs for the poor such that that the chosen tax rate is optimal. Suppose the beliefs of the poor are as follows, let $\tau^* \in [\underline{\tau}, \overline{\tau})$ be such that

$$\begin{aligned} \rho(\mu^j \mid \tau \in [\underline{\tau}, \tau^*]) &= \rho(\mu^j)\ j = h, l, \\ \rho(\mu^h \mid \tau \in (\tau^*, \overline{\tau}]) &= 1. \end{aligned} \tag{20}$$

That is observations of a tax rate at or below some threshold τ^* are considered uninformative, whereas tax rates above the threshold are believed to be revealing of the high state. Now provided $V(y_r \mid \tau_r, \mu^h, \rho(\mu^h)) \geq V(y_r \mid \overline{\tau}, \mu^h, 1)$ the rich choose $\tau_r \in [\underline{\tau}, \overline{\tau})$, that is they prefer a tax rate that admits a positive probability of revolution to one that eliminates this threat. However for

[4] The payoff function $V(y_r \mid \overline{\tau}, \mu^l, \rho(\mu^l))$ should be read as the value of discounted expected indirect utility given the agent recieves the income level of the rich y_r, the single tax rate is $\overline{\tau}$, the current state is μ^l, and the beliefs of the poor are given by their initial priors $\rho(\mu^l)$.

this to be an equilibrium also requires they select the same $\tau_r \in [\underline{\tau}, \overline{\tau})$ in both states. To this end suppose $\tau_r^l = Arg\max\limits_{\tau_r} V(y_r \mid \tau_r, \mu^l, \rho(\mu^l))$ and $\tau_r^h = Arg\max\limits_{\tau_r} V(y_r \mid \tau_r, \mu^h, \rho(\mu^h))$ now provided $\tau_r^h > \tau_r^l = \tau^*$, which must be the case or beliefs would not be consistent, then $\tau_r = \tau^*$, and optimality requires $V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) \geq V(y_r \mid \overline{\tau}, \mu^h, 1)$. The intuition here is that the poor take any tax rate above τ^* as a signal that the state of the world is high with probability one, given this if the rich choose a tax rate above τ^* they must choose $\tau = \overline{\tau}$ or revolution is a certainty. Alternatively if the rich set the tax rate at τ^* for both states then no information is revealed and the rich may avoid the tax cost of completely eliminating the risk of rebellion[5].

Figures 2 a and b illustrate the conditions under which the equilibrium involves insecure and oligarchy respectively

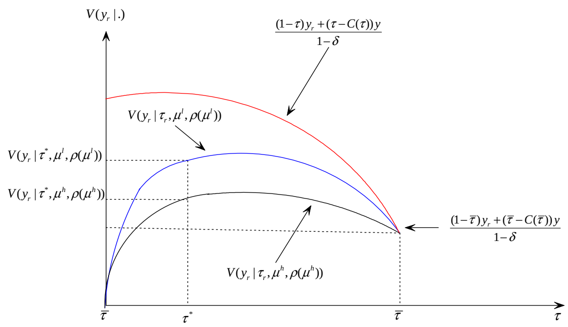

Figure 2a: Insecure Oligarchy

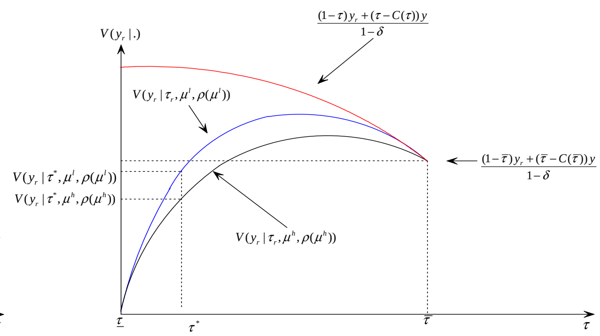

Figure 2b: Secure Oligarchy

A crucial element in whether or not the oligarchic equilibrium involves a positive probability of rebellion is how sensitive the conditional probability of rebellion is to changes in the tax rate. Hence it is necessary to provide the microfoundations underlying the decisions of the poor to engage in rebellious acts. To accomplish this we draw on the literature on information cascades developed by Banerjee (op. cit.), Bikhchandani, Hirshleifer, and Welch (op. cit.) and previously applied as a theory of political mass protest by Lohmann (op. cit.).

3.7 The Microfoundations of Rebellion

Rebellion is possible whenever in oligarchy the rich set a tax rate on the interval $\tau_r \in [\underline{\tau}, \overline{\tau})$. In these circumstances if a poor agent is "confident enough" that the state is high they will engage in a rebellious act and the probability that a successful rebellion will ultimately arise is non-zero. To model this idea we begin with a couple of relatively unrestrictive but useful simplifying assumptions. First for a successful rebellion to take place we require all poor agents participate in the revolt. Second we assume that in each period each poor agent chooses between two actions; they may engage in a visible act of political protest, $a = a^v$, or may remain passively at home $a = a^o$. These

[5] Note that if $V(y_r \mid \tau^*, \mu^l, \rho(\mu^l)) > V(y_r \mid \overline{\tau}, \mu^h, 1) > V(y_r \mid \tau^*, \mu^h, \rho(\mu^h))$ it might seem that no equlibrium exists, but in this case the beliefs of the poor would not be consistent in the low state. Hence τ^* must be chosen to eliminate this possibility.

actions are not directly costly. Third we assume that the poor make their decisions in a sequence known to themselves alone.[6]

The poor agents are Bayesians. After observing the actions of the rich, and making any appropriate inferences, each receives a private signal s^i which is informative but imperfectly correlated with the true state of the world μ. Sequentially they chose whether or not to engage in an act of political protest or remain passive. The poor each observe the choices made by their counterparts earlier in the sequence, and on the basis of these observations they update their beliefs in a Bayesian fashion. The informational environment in which the poor are operating is therefore one where information cascades occur.

Consider the poor agent i with beliefs about the state of the world characterized by the conditional probability

$$\rho_i(\mu^j \mid s^j, A^{-i}) \tag{21}$$

where A^{-i} is a vector of the actions chosen by all the poor agents prior to agent i. We know by construction of the case that the poor agent i would prefer rebellion if they knew with certainty the state to be high, whereas they would prefer to not rebel if they knew with certainty the state to be low. Writing $V(y_p \mid \tau_r)$ as the indirect utility of the poor if there is no revolution in the current period[7] then for any given $\tau_r \in (\underline{\tau}, \overline{\tau})$ the following inequities hold

$$V(y_p \mid 0, \mu^h) > V(y_p \mid \tau_r) > V(y_p \mid 0, \mu^l) \tag{22}$$

an immediate implication of this is that for any agent i there is a critical probability ρ^* such that for all $\rho_i(\mu^h \mid s^j, A^{-i}) \geq \rho^*$ this agent prefers there be a rebellion and will choose the rebellious act. ρ^* is defined by

$$\rho^* V(y_p \mid 0, \mu^h) + (1 - \rho^*) V(y_p \mid 0, \mu^l) = V(y_p \mid \tau_r) \tag{23}$$

or

$$\rho^* = \frac{V(y_p \mid \tau_r) - V(y_p \mid 0, \mu^l)}{V(y_p \mid 0, \mu^h) - V(y_p \mid 0, \mu^l)} \tag{24}$$

This "Political Protest Condition" is one of two key expressions How the beliefs of the poor agents evolve and how they are effected by the taxes set by the rich τ_r depends on the inferences they make from observing the actions of each other.

3.7.1 The Evolution of Poor Agents Beliefs and Actions

We assume that the first poor agent will rebel if they receive the signal $s_1 = s_1^h$ but not otherwise. That is $\rho_1(\mu^h \mid s_1^h) \geq \rho^* > \rho_1(\mu^h \mid s_1^l)$. Were this not the case a rebellion would only occur with probability one or zero. Following the choice of the first poor agent the remainder update their beliefs on the basis of the signal they receive and the inferences they make about their predecessors signals given the actions they chose. All poor agents know that a rebellion requires unanimity,

[6] Loosely we might think that there are malcontents amongst the poor who act first, but their identity is kept secret for purposes of personal safety.

[7] $V(y_p \mid \tau_r)$ may be written as $F(y_p \mid \tau_r) + \delta \left[\rho\left(\mu^h\right)\left[\beta\left(\mu^h \mid \tau_r\right) V(y_p \mid 0, \mu^h) + \left(1 - \beta\left(\mu^h \mid \tau_r\right)\right) V(y_p \mid \tau_r, \mu^h)\right]\right.$ $\left. + \rho\left(\mu^l\right)\left[\beta\left(\mu^l \mid \tau_r\right) V(y_p \mid 0, \mu^l) + \left(1 - \beta\left(\mu^l \mid \tau_r\right)\right) V(y_p \mid \tau_r, \mu^l)\right]\right]$ which by solving the geometric series reduces to $\left(\frac{F(y_p|\tau_r) + \delta\rho\left(\mu^h\right)\beta\left(\mu^h|\tau_r\right)V(y_p|0,\mu^h) + \rho\left(\mu^l\right)\beta\left(\mu^l|\tau_r\right)V(y_p|0,\mu^l)}{1-\delta\left[\rho(\mu^h)(1-\beta(\mu^h|\tau_r)) + \rho(\mu^l)(1-\beta(\mu^l|\tau_r))\right]}\right)$

hence we assume that once one agent chooses $a_k = a_k^o$ then the remaining $m - k$ will do likewise. Using Bayes rule the beliefs of the i^{th} poor agent having observed all preceding agents choose $a_k = a_k^v$ may be written

$$\rho_i(\mu^h \mid s^h \cap A^{-i}) = \frac{\rho_i(s^h \cap A^{-i} \mid \mu^h)\rho(\mu^h)}{\rho_i(s^h \cap A^{-i} \mid \mu^h)\rho(\mu^h) + \rho_i(s^h \cap A^{-i} \mid \mu^l)\rho(\mu^l)} \tag{25}$$

where $\rho_i(s^h \cap A^{-i} \mid \mu^h) = \rho(s^h \mid \mu^h)^i$ and $\rho_i(s^h \cap A^{-i} \mid \mu^l) = \rho(s^h \mid \mu^l)^i$ so the beliefs of agent i on receipt of the signal s^h may be rewritten

$$\rho_i(\mu^h \mid s^h \cap A^{-i}) = \frac{\rho(s^h \mid \mu^h)^i\rho(\mu^h)}{\rho(s^h \mid \mu^h)^i\rho(\mu^h) + \rho(s^h \mid \mu^l)^i\rho(\mu^l)} \tag{26}$$

Lemma 7 *If the first poor agent on receiving the signal s_1^h chooses $a_1 = a_1^v$ then each successive poor agent that receives the signal s_k^h also chooses $a_k = a_k^v$.*

3.7.2 Information Cascades

Each poor agent chooses the action $a = a^v$ if they are sufficiently confident that the state of the world is μ^h. Once a large enough number of poor agents have chosen an act of political protest then the priors that subsequent poor agents derive from observing these actions "swamp" their own signals, that is

Proposition 8 $\exists$ *an $\bar{i}$ such that if all $i < \bar{i}$ chose $a = a^v$ then all $i \geq \bar{i}$ will choose $a = a^v$ irrespective of their idiosyncratic signals. Furthermore $\bar{i} = int\left(\frac{\ln\left[\left(\frac{1-\rho^*}{\rho^*}\right)\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\right)\left(\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)\right]}{\ln\left[\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right]}\right) + 1$ (where int indicates the integer part of the term), and is hence non-decreasing in ρ^*.*

Proposition 8 tells us that if the first $\bar{i} - 1$ poor agents receive the signal s^h and choose the action a^v then all subsequent agents will neglect their own signals and behave similarly. There is an information cascade. Writing this condition in slightly different form we get (see the proof of proposition 8) the "Cascade Condition"

$$\rho^* = \frac{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)}{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right) + \left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)^{\bar{i}-1}} \tag{27}$$

3.7.3 The Probability of Revolution

Given that it requires the first $\bar{i}-1$ poor agents receive the signal s^h for an information cascade and hence revolution to occur then the conditional probabilities of rebellion are

$$\beta(\mu^h \mid \tau_r) = \rho(s^h \mid \mu^h)^{\bar{i}-1} \tag{28}$$

$$\beta(\mu^l \mid \tau_r) = \rho(s^h \mid \mu^l)^{\bar{i}-1} \tag{29}$$

and the unconditional probability is

$$\beta(\tau_r^*) \equiv \rho(s^h \mid \mu^h)^{\bar{i}-1}\rho(\mu^h) + \rho(s^h \mid \mu^l)^{\bar{i}-1}\rho(\mu^l) \tag{30}$$

If the rich set the state invariant tax rate τ_r then the critical probability becomes $\rho^* = \frac{V(y_p|\tau_r)-V(y_p|0,\mu^l)}{V(y_p|0,\mu^h)-V(y_p|0,\mu^l)}$ which is increasing in τ_r for all $\tau_r \in [0,\tau_p^d]$. Since $\bar{i}$ is non-decreasing in ρ^* and the $\beta's$ are decreasing in $\bar{i}$ it follows that the probability of a successful rebellion is non-increasing in the tax rate set by the rich. Hence in setting the tax rate, τ_r, the rich face a trade-off between paying lower taxes themselves and a higher probability that a rebellion will succeed. We may now explore the circumstances under which a rebellion is more likely'

Proposition 9 *In any stable oligarchic equilibrium a revolution is more likely to occur if (i) the destruction due to revolution is less, that is the smaller is μ^h, (ii) the less efficient is the tax system, that is the larger is $C(\tau_r)$, (iii) the relatively more impoverished are the poor , that is the smaller is y_p/y,*

Again these conclusions are largely intuitive. The first part of the proposition states that the poor are more likely to rebel when the destruction due to rebellion is lower. The mechanism here operates as follows: If the destruction due to rebellion is less then the critical probability that induces each poor agent to choose an act of political protest is lower and hence the fewer are the "high" signals required to reach the point where an agents priors will cause their beliefs to exceed this value irrespective of their own signal, the cascade starts after fewer "high" signals. Part (ii) arises because if the tax system is less efficient then for any tax the net transfers from rich to poor are smaller, this raises the relative value to the poor of rebellion, lowering the critical probability ρ^* this makes a rebellion more likely as it is exceeded by agents priors after fewer "high" signals. Part (iii) simply states that if the poor are relatively less prosperous, then as the poor seize the larger endowments of the rich after a successful rebellion it takes less in terms of a probability attached to the state being high for the poor to choose an act of political protest. Figures 3a and 3b illustrate these comparative statics results.

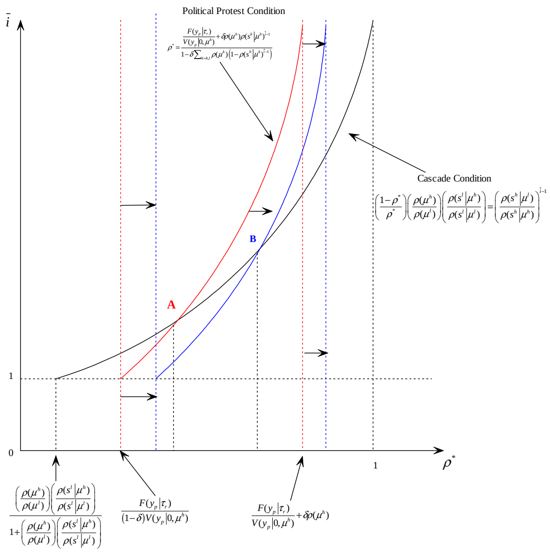

Figure 3a: High State is Unlikely

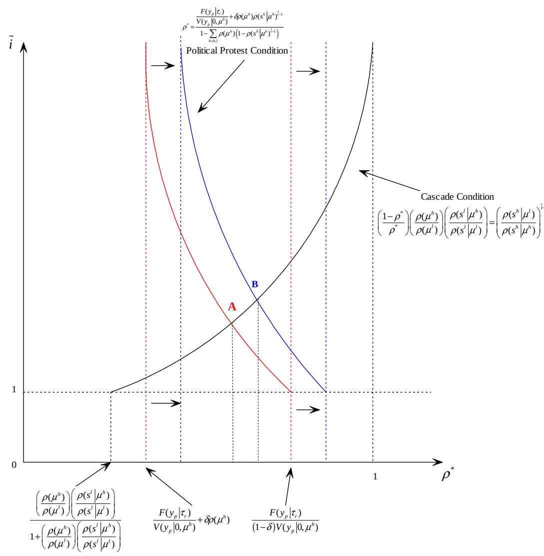

Figure 3b: High State is Likely

We see that each of the claims made in proposition 9 can be represented in figure 3 by a rightward shift in the political protest condition leading to an increase in the equilibrium level of $\bar{i}$ which we know from (28)-(30) leads to an increase in the probability of rebellion in both states of the world.

3.8 Equilibria

Despite its complexity there are only three possible pure strategy equilibrium outcomes for this game; inequitable democracy, secure oligarchy, or insecure oligarchy. Formally we may state

Proposition 10 $\exists$ *admissible parameter values such that each of the three equilibria may arise.*

This is perhaps unsurprising, if we consider some of the extreme cases the intuition becomes clear. Suppose for example that the probability of the high state occurring were close to zero, then the rich would have little incentive to instigate democracy, nor would they set high taxes as the likelihood of a rebellion is approximately zero. Insecure oligarchy would characterize the equilibrium. Alternatively, suppose the probability of a high state is close to one and the quality of the signal received by the poor is high, a revolution is very likely unless the rich set high taxes either directly in a secure oligarchy or indirectly by conceding democracy.

3.8.1 Secure Oligarchy, Insecure Oligarchy or Democracy

We are now in a position to characterize the initial conditions of an economy in terms of the deep parameters of our model that lead to the three possible equilibrium types. These deep parameters include: The efficiency of the tax system, $C(\tau_r)$, the quality of poor agents information, $\rho(s^j \mid \mu^k)$ $j = h, l,\ k = h, j$ (which may be thought of as representing the openness of the society), the destruction arising from a rebellion, μ^j $j = h, l,$ (which might be thought of as representing the repressiveness of the society), the society's demographics in the sense that the oligarchs may consist of a few super-rich or a large number of moderately affluent individuals. The conclusions of this section may be verified by inspecting the proof of proposition 10. The possibilities are illustrated in figures 4a and 4b. In 4a we illustrate circumstances where the rich will select either secure oligarchy or democracy dependent on which involves the lower tax rate. In 4b small tax concessions in an insecure oligarchy are sufficient to greatly reduce the likelihood of rebellion making this the rich's desired option.

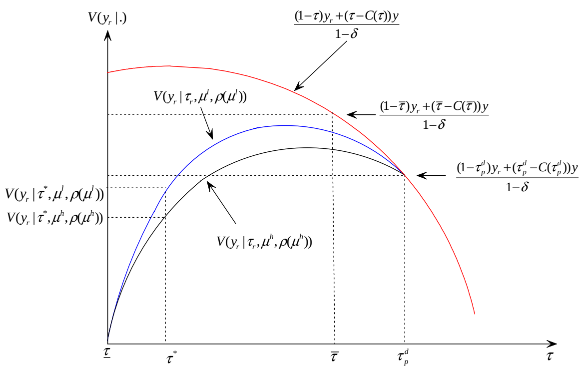

Figure 4a: Secure Oligarchy or Democracy

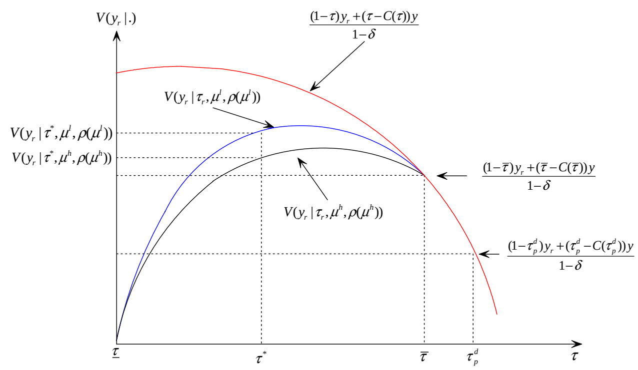

Figure 4b: Insecure Oligarchy

Information Quality. The quality of information received by the poor is characterized by the signals $\rho(s^j \mid \mu^k)$ $j = h, l$, $k = h, l$, as $\rho(s^j \mid \mu^k) \to 1$ for $j = k$ the poor are increasingly well informed about the state of the world. In very closed, secretive, societies where $\rho(s^j \mid \mu^k) \to \frac{1}{2}$ $\forall j = h, l$, $k = h, l$ $j = k$ the threat of rebellion is low as it takes many agents to receive the signal s^h for an information cascade to be triggered. Here the rich tend to choose insecure oligarchy they optimally set low taxes, which yield only small net transfers from themselves to the poor and accept the small risk of rebellion.

The Destructiveness of a Revolution. While we have treated μ^j $j = h, l$ as exogenous states of the world, it makes sense to think of them as being determined in part by the characteristics of the society and in part by prior investments by the rich. For example if a society is in some sense tribal then well organized social groups may conflict over resources raising the potential for destruction. Also, if the rich have made significant prior investments in the police, security services or the military then again the damage from revolution will be substantial. In both these cases the model predicts that oligarchy will persist in either the insecure variety with low probabilities of rebellion, or the secure variety where the tax needed to deter rebellion is quite low. Alternatively if the destruction due to a revolution is negligible then we would anticipate the rich conceding democracy.

The Efficiency of the Tax System. If the tax system is highly efficient, that is $C(\tau_r)$ is low for any τ_r then it is relatively inexpensive for the rich to persuade the poor not to rebel and the model predicts oligarchy in one of its two forms. Alternatively if the tax system is highly inefficient, perhaps due to tax evasion and the like, then the rich may have little option but to instigate democracy.

The Demographics of the Rich. For any given level of endowment income per rich agent, a larger the numbers of rich has two effects on the potential regime. First if there are more rich a lower tax rate is associated with any level of redistribution from rich to poor, making the per rich agent costs lower both because of the lower taxes, and because the losses due to the distortion the $C(\tau_r)'s$ are lower. However, for a given population more rich means fewer poor which the consequence that the returns per poor agent to revolution are greater.

4 Conclusions

In this paper we have examined the economic forces behind political regime determination in a world where information is asymmetric, this is accomplished by combing Acemoglu's model of the economics of political regime determination with Lohmann's model of political mass protest. By doing this we are able to provide some microfoundations for the threat of rebellion central to the explanation of political regime determination. The resulting structure allows us to explain many complexities that were heretofore outside the scope of the literatures on which we draw. Most particularly we are able to explain circumstances where democracy arrives both after a peaceful transition in the sense of Acemoglu and after a revolution. We are also able to explain when an oligarchic regime is stable and when it is inevitably replaced by democracy. Furthermore, democracy or its absence can constitute errors in an ex-post paretian sense; the poor may rebel in circumstances were the destruction due to revolution makes this unwise, and may fail to do so when the circumstances are ripe.

Which particular equilibrium of the model arrises can be related to the deep structural features of society. Our main contribution is perhaps to model the information transmission process that leads to a possible rebellion and then use this to gain new insights into the determination of political regimes. In our analysis whether a society is characterized by an openness of information is represented by the quality of the signals received by the poor. In open societies of this nature our model predicts that it is difficult for the rich to sustain an oligarchy, and democracy tends to arise. By modelling the process by which rebellions arise we also get insights into how other structural features of an economy translate into particular political regimes. For example highly factionalized societies might be anticipated to experience severe damage from rebellion, this makes it relatively inexpensive for the rich to continue with oligarchy.

5 Appendix

Proof of Proposition 1.

1. *$T_p = 0$ in the second period as* $(1+\delta)\, y_r - \left(\frac{m}{n-m}\right)\overline{T} > (1+\delta)\left[y_r - \left(\frac{m}{n-m}\right)\overline{T}\right]$ *and there is no threat of revolution in the second period. $T_p = \overline{T}$ in the first period since* $(1+\delta)\, y_p + \overline{T} > (1+\delta)\left(y_p + \left(\frac{n-m}{m}\right) y_r\right)(1-\mu^l)$. *as the rich must offer $T_p = \overline{T}$ to prevent a revolution. The rich do not extend the franchise because* $(1+\delta)\, y_r - \left(\frac{m}{n-m}\right)\overline{T} > (1+\delta)\left[y_r - \left(\frac{m}{n-m}\right)\overline{T}\right]$.

2. *Note first that as in the first part $T_p = 0$ in the second period as* $(1+\delta)\, y_r - \left(\frac{m}{n-m}\right)\overline{T} > (1+\delta)\left[y_r - \left(\frac{m}{n-m}\right)\overline{T}\right]$ *and there is no threat of revolution. Now,* $(1+\delta)\left(y_p + \overline{T}\right) > (1+\delta)\left(y_p + \left(\frac{n-m}{m}\right) y_r\right)(1-\mu^h) > (1+\delta)\, y_p + \overline{T}$ *which implies the poor rebel unless offered $T_p = \overline{T}$ in both periods. Since* $(1+\delta)\left[y_r - \left(\frac{m}{n-m}\right)\overline{T}\right] > 0$ *the rich wish to offer $T_p = \overline{T}$ in both periods and so must extend the franchise.* ■

Proof of Proposition 2. *First we eliminate several options as equilibrium strategies for the rich. We note that the rich cannot choose positive transfers in one state and none in the other. Suppose the rich chose $\{\overline{T}^h, 0^l\}$,then on observing $T_p = \overline{T}$ the poor know the state is high and since* $(1+\delta)\left(y_p + \left(\frac{n-m}{m}\right) y_r\right)(1-\mu^h) > (1+\delta)\, y_p + \overline{T}$, *they rebel with probability 1 that is $\beta(h, \overline{T}, 0) = 0$. On observing $T_p = 0$ the poor know the state is low. but since* $(1+\delta)\left(y_p + \left(\frac{n-m}{m}\right) y_r\right)(1-\mu^l) > (1+\delta)\, y_p$ *they again choose rebellion that is $\beta(l, \overline{T}, 0) = 0$. Hence this cannot be an equilibrium strategy for the rich. Now suppose the rich chose $\{0^h, \overline{T}^l\}$. Now the poor will not rebel in the low state since* $(1+\delta)\, y_p + \overline{T} > (1+\delta)\left(y_p + \left(\frac{n-m}{m}\right) y_r\right)(1-\mu^l)$, *however since* $(1+\delta)\left(y_p + \left(\frac{n-m}{m}\right) y_r\right)(1-\mu^h) > (1+\delta)\, y_p + \overline{T}$ *the poor would rebel in the high state. But observations on T_p would be revealing, hence the rich would set $T_p = \overline{T}$ in both states avoiding rebellion, but this contradicts the idea that transfers are revealing, thus $\{0^h, \overline{T}^l\}$ also cannot be an equilibrium strategy for the rich. This leaves two possibilities under oligarchy $\{0^h, 0^l\}$ and $\{\overline{T}^h, \overline{T}^l\}$. We may immediately exclude $\{0^h, 0^l\}$ the payoff structure immediately implies $\beta(l, 0, 0) = \beta(h, 0, 0) = 0$, rebellion is certain in both states. Hence there are only two options remaining oligarchy with $\{\overline{T}^h, \overline{T}^l\}$ or franchise extension. Writing the expected payoffs for the rich in the two cases we get that franchise extension will not be chosen if* $\beta(h, \overline{T}, \overline{T})\left[(1+\delta)\, y_r - \overline{T}\right] \geq (1+\delta)\left(y_r - \overline{T}\right)$ *manipulating this expression gives* $\beta(h, \overline{T}, \overline{T}) \geq \frac{(1+\delta)\left(y_r - \overline{T}\right)}{(1+\delta) y_r - \overline{T}}$ *as required. The rest of the proof is definitional.* ■

Proof of Lemma 4. *(a)* $\frac{\partial F(y_r|\tau_p)}{\partial \tau_p} < 0$ *as* $\tau_p \lessgtr \tau_p^d$. *We have* $F(y_r \mid \tau_p) = (1-\tau_p) y_r + (\tau_p - C(\tau_p))\, y$, *so differentiating with respect to τ_p we get* $\frac{\partial F(y_r|\tau_p)}{\partial \tau_p} = (1 - C'(\tau_p))\, y - y_r$ *now* $C'(\tau_p) > 0$ *and $y < y_r$ and the result follows as required. (b)* $\frac{\partial F(y_p|\tau_p, n)}{\partial \tau_p} \gtrless 0$ *as* $\tau_p \lessgtr \tau_p^d$ *now differentiating* $F(y_p \mid \tau_p) = (1-\tau_p) y_p + (\tau_p - C(\tau_p))\, y$ *gives* $\frac{\partial F(y_r|\tau_p)}{\partial \tau_p} = (1 - C'(\tau_p))\, y - y_p$ *again* $C'(\tau_p) > 0$ *but now $y > y_p$ and the result again follows as required.* ■

Proof of Proposition 5. *Suppose contrary to the proposition that taxes were fully revealing of the state, then the rich set taxes that satisfy the no-revolution conditions* $(1-\tau_r^j) y_p + \left(\tau_r^j - C(\tau_r^j)\right) y =$

$y(1-\mu^j)\left(\frac{n}{m}\right)$ $j = h, l$, *but since* $\mu^h \neq \mu^l$ *then* $\tau_r^h \neq \tau_r^l$, *and by lemma 4 the rich set the lower tax rate for all* μ^j *contradicting taxes being revealing.* ■

Proof of Corollary 6. *Follows immediately from proposition 5.* ■

Proof of Lemma 7. *This follows immediately from noting that* $\rho_i(\mu^h \mid s^h \cap A^{-i}) = \frac{\rho(s^h|\mu^h)^i \rho(\mu^h)}{\rho(s^h|\mu^h)^i \rho(\mu^h) + \rho(s^h|\mu^l)^i \rho(\mu^l)}$ *is monotonically increasing in* i *hence if* $\rho_1(\mu^h \mid s^h \cap A^{-1}) > \rho^*$ *so too must* $\rho_i(\mu^h \mid s^h \cap A^{-i}) > \rho^*$ $\forall i > 1$. ■

Proof of Proposition 8. *We wish to show* $\exists$ *an* $\bar{i}$ *such that if all* $i < \bar{i}$ *chose* $a = a^v$ *then all* $i \geq \bar{i}$ *will choose* $a = a^v$ *irrespective of their idiosyncratic signals. First note that we may write* $\frac{1}{\rho_i(\mu^h|s^h \cap A^{-i})} = 1 + \frac{\rho(s^h|\mu^l)^i \rho(\mu^l)}{\rho(s^h|\mu^h)^i \rho(\mu^h)}$. *Now using L'Hopital's rule we may state* $\lim_{i\to\infty}\left(\frac{1}{\rho_i(\mu^h|s^h\cap A^{-i})}\right) \to 1$ *which implies* $\lim_{i\to\infty} \rho_i(\mu^h \mid s^h \cap A^{-i}) \to 1$ *and by Lemma 7 we know* $\rho_i(\mu^h \mid s^h \cap A^{-i})$ *is monotonically increasing in* i. *It now follows that for any* $\rho^* \in [0,1)$ *we can find an* $\bar{i}$ *such that* $\rho_{\bar{i}-1}(\mu^h \mid s^h \cap A^{-(\bar{i}-1)}) > \rho^*$ *now by Bayes rule if the* $\bar{i}^{\text{th}}$ *individual receives the signal* s^l *their posterior beliefs are* $\rho_{\bar{i}}(\mu^h \mid s^l \cap A^{-\bar{i}}) = \frac{\rho(s^l|\mu^h)\rho_{\bar{i}-1}(\mu^h|s^h\cap A^{-\bar{i}-1})}{\rho(s^l|\mu^h)\rho_{\bar{i}-1}(\mu^h|s^h\cap A^{-(\bar{i}-1)}) + \rho(s^l|\mu^l)\rho_{\bar{i}-1}(\mu^l|s^h\cap A^{-(\bar{i}-1)})}$ *but as* $\lim_{\bar{i}\to\infty} \rho_{\bar{i}}(\mu^h \mid s^h \cap A^{-(\bar{i}-1)}) \to 1$ *then* $\lim_{\bar{i}\to\infty} \rho_{\bar{i}}(\mu^l \mid s^h \cap A^{-(\bar{i}-1)}) \to 0$ *and hence from the posterior beliefs we have* $\lim_{\bar{i}\to\infty} \rho_{\bar{i}}(\mu^h \mid s^l \cap A^{-\bar{i}}) \to 1$ *so that we can find an* $\bar{i}$ *as required. Now to identify the value of* $\bar{i}$ *we first allow it to take non-integer values and solve* $\rho^* = \rho_{\bar{i}}(\mu^h \mid s^l \cap A^{-\bar{i}})$ *using*

$$\begin{aligned}
\rho^* = \rho_{\bar{i}}(\mu^h \mid s^l \cap A^{-\bar{i}}) &= \frac{\rho(s^l \mid \mu^h)\rho_{\bar{i}-1}(\mu^h \mid s^h \cap A^{-(\bar{i}-1)})}{\rho(s^l \mid \mu^h)\rho_{\bar{i}-1}(\mu^h \mid s^h \cap A^{-(\bar{i}-1)}) + \rho(s^l \mid \mu^l)\rho_{\bar{i}-1}(\mu^l \mid s^h \cap A^{-(\bar{i}-1)})} \\
&= \frac{\rho(s^l \mid \mu^h)\left[\frac{\rho(s^h|\mu^h)^{\bar{i}-1}\rho(\mu^h)}{\rho(s^h|\mu^h)^{\bar{i}-1}\rho(\mu^h)+\rho(s^h|\mu^l)^{\bar{i}-1}\rho(\mu^l)}\right]}{\rho(s^l \mid \mu^h)\left[\frac{\rho(s^h|\mu^h)^{\bar{i}-1}\rho(\mu^h)}{\rho(s^h|\mu^h)^{\bar{i}-1}\rho(\mu^h)+\rho(s^h|\mu^l)^{\bar{i}-1}\rho(\mu^l)}\right] + \rho(s^l \mid \mu^l)\left[1 - \frac{\rho(s^h|\mu^h)^{\bar{i}-1}\rho(\mu^h)}{\rho(s^h|\mu^h)^{\bar{i}-1}\rho(\mu^h)+\rho(s^h|\mu^l)^{\bar{i}-1}\rho(\mu^l)}\right]} \\
&= \frac{\rho(s^l \mid \mu^h)\rho(s^h \mid \mu^h)^{\bar{i}-1}\rho(\mu^h)}{\rho(s^l \mid \mu^h)\rho(s^h \mid \mu^h)^{\bar{i}-1}\rho(\mu^h) + \rho(s^l \mid \mu^l)\rho(s^h \mid \mu^l)^{\bar{i}-1}\rho(\mu^l)}
\end{aligned}$$

and rearranging we get

$$\left(\frac{1-\rho^*}{\rho^*}\right)\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l \mid \mu^h)}{\rho(s^l \mid \mu^l)}\right) = \left(\frac{\rho(s^h \mid \mu^l)}{\rho(s^h \mid \mu^h)}\right)^{\bar{i}-1}$$

taking logs and rearranging gives

$$\bar{i} = 1 + \frac{\ln\left[\left(\frac{1-\rho^*}{\rho^*}\right)\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\right)\left(\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)\right]}{\ln\left[\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right]}$$

$\bar{i}$ *is then the integer part and is as in the text.* ■

Proof of Proposition 9. *The proof of proposition 9 involves demonstrating that figures 3a and 3b are an accurate representation of the equilibrium determination of ρ^* and $\bar{i}$. We need to derive the properties of the "political protest" and "cascade conditions".*

$$\rho^* = \frac{\frac{F(y_p|\tau_r)}{V(y_p|0,\mu^h)} + \delta\rho\left(\mu^h\right)\rho(s^h \mid \mu^h)^{\bar{i}-1}}{1-\delta\left[\rho\left(\mu^h\right)\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right) + \rho\left(\mu^l\right)\left(1-\rho(s^h \mid \mu^l)^{\bar{i}-1}\right)\right]}$$

and

$$\rho^* = \frac{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)}{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right) + \left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)^{\bar{i}-1}}$$

Taking limits of these expressions as $\bar{i} \to 1$ and $\bar{i} \to \infty$ we get

$$\lim_{\bar{i}\to 1}\left(\frac{\frac{F(y_p|\tau_r)}{V(y_p|0,\mu^h)} + \delta\rho\left(\mu^h\right)\rho(s^h \mid \mu^h)^{\bar{i}-1}}{1-\delta\sum_{k=h,l}\rho\left(\mu^k\right)\left(1-\rho(s^h \mid \mu^k)^{\bar{i}-1}\right)}\right) \to \frac{F(y_p \mid \tau_r)}{V(y_p \mid 0,\mu^h)} + \delta\rho\left(\mu^h\right)$$

$$\lim_{\bar{i}\to \infty}\left(\frac{\frac{F(y_p|\tau_r)}{V(y_p|0,\mu^h)} + \delta\rho\left(\mu^h\right)\rho(s^h \mid \mu^h)^{\bar{i}-1}}{1-\delta\sum_{k=h,l}\rho\left(\mu^k\right)\left(1-\rho(s^h \mid \mu^k)^{\bar{i}-1}\right)}\right) \to \frac{F(y_p \mid \tau_r)}{V(y_p \mid 0,\mu^h)(1-\delta)}$$

and

$$\lim_{\bar{i}\to 1}\left(\frac{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)}{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right) + \left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)^{\bar{i}-1}}\right) \to \frac{\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}}{1+\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}}$$

$$\lim_{\bar{i}\to \infty}\left(\frac{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)}{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right) + \left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)^{\bar{i}-1}}\right) \to 1$$

Next differentiating the two expressions with respect to ρ^* *and* $\bar{i}$ *we get*

$$\begin{aligned}
\left.\frac{d\rho^*}{d\bar{i}}\right|_{protest} &= \frac{\delta\rho\left(\mu^h\right)\rho(s^h \mid \mu^h)^{\bar{i}-1}\ln\rho(s^h \mid \mu^h)\left[1-\delta\sum_{k=h,l}\rho\left(\mu^k\right)\left(1-\rho(s^h \mid \mu^k)^{\bar{i}-1}\right)\right]}{\left[1-\delta\sum_{k=h,l}\rho\left(\mu^k\right)\left(1-\rho(s^h \mid \mu^k)^{\bar{i}-1}\right)\right]^2} \\
&+\frac{\delta\sum_{k=h,l}\rho\left(\mu^k\right)\left(1-\rho(s^h \mid \mu^k)^{\bar{i}-1}\right)\ln\rho(s^h \mid \mu^k)\left[\frac{F(y_p|\tau_r)}{V(y_p|0,\mu^h)}+\delta\rho\left(\mu^h\right)\rho(s^h \mid \mu^h)^{\bar{i}-1}\right]}{\left[1-\delta\sum_{k=h,l}\rho\left(\mu^k\right)\left(1-\rho(s^h \mid \mu^k)^{\bar{i}-1}\right)\right]^2} \\
&= \frac{(1-\rho^*)\,\delta\rho\left(\mu^h\right)\rho(s^h \mid \mu^h)^{\bar{i}-1}\ln\rho(s^h \mid \mu^h)-\rho^*\delta\rho\left(\mu^l\right)\rho(s^h \mid \mu^l)^{\bar{i}-1}\ln\rho(s^h \mid \mu^l)}{1-\delta\sum_{k=h,l}\rho\left(\mu^k\right)\left(1-\rho(s^h \mid \mu^k)^{\bar{i}-1}\right)} \gtrless 0
\end{aligned}$$

and

$$\left.\frac{d\rho^*}{d\bar{i}}\right|_{cascade} = -\frac{\left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)^{\bar{i}-1}\ln\left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)}{\left[\left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)^{\bar{i}-1}+\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)\right]^2} > 0$$

Now as $\bar{i} \to 1$ *and* $\bar{i} \to \infty$ *we get*

$$\lim_{\bar{i}\to 1}\left(\left.\frac{d\rho^*}{d\bar{i}}\right|_{protest}\right) \to (1-\rho^*)\,\delta\rho\left(\mu^h\right)\ln\rho(s^h \mid \mu^h)-\rho^*\delta\rho\left(\mu^l\right)\ln\rho(s^h \mid \mu^l)$$

$$\lim_{\bar{i}\to\infty}\left(\left.\frac{d\rho^*}{d\bar{i}}\right|_{protest}\right) \to 0$$

and

$$\lim_{\bar{i}\to 1}\left(\left.\frac{d\rho^*}{d\bar{i}}\right|_{cascade}\right) \to -\frac{\ln\left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)}{\left[1+\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)\right]^2} > 0$$

$$\lim_{\bar{i}\to\infty}\left(\left.\frac{d\rho^*}{d\bar{i}}\right|_{cascade}\right) \to 0$$

Further note that the cascade condition is invariant with respect to $F(y_p \mid \tau_r), V(y_p \mid 0, \mu^h)$ *and* δ *whereas the protest condition has the properties*

$$\begin{aligned}
\left.\frac{d\rho^*}{dF(y_p \mid \tau_r)}\right|_{\bar{i}} &= \frac{\frac{1}{V(y_p|0,\mu^h)}}{1-\delta\left[\rho\left(\mu^h\right)\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)+\rho\left(\mu^l\right)\left(1-\rho(s^h \mid \mu^l)^{\bar{i}-1}\right)\right]} > 0 \\
\left.\frac{d\rho^*}{dV(y_p \mid 0,\mu^h)}\right|_{\bar{i}} &= \frac{-\frac{F(y_p|\tau_r)}{[V(y_p|0,\mu^h)]^2}}{1-\delta\left[\rho\left(\mu^h\right)\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)+\rho\left(\mu^l\right)\left(1-\rho(s^h \mid \mu^l)^{\bar{i}-1}\right)\right]} < 0
\end{aligned}$$

which immediately leads to the conclusions reported in proposition 9 when $\left.\frac{d\rho^*}{d\bar{i}}\right|_{protest} < 0$ *and also gives these results when* $\left.\frac{d\rho^*}{d\bar{i}}\right|_{protest} > \left.\frac{d\rho^*}{d\bar{i}}\right|_{cascade} > 0$ *which are easily seen to be necessary conditions for stability of the equilibrium.* ■

Proof of Proposition 10. *To demonstrate this proposition we need to show there exist parameter values such that* $V(y_r \mid \tau_p^d) > Max\left\{V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)), V(y_r \mid \overline{\tau}, \mu^h, 1)\right\}$, $V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) > Max\left\{V(y_r \mid \tau_p^d), V(y_r \mid \overline{\tau}, \mu^h, 1)\right\}$, *and* $V(y_r \mid \overline{\tau}, \mu^h, 1) > Max\left\{V(y_r \mid \tau_p^d), V(y_r \mid \tau^*, \mu^h, \rho(\mu^h))\right\}$ *can each hold. Note first that* $\tau_p^d \geq \overline{\tau} > \tau^* \Rightarrow F(y_r \mid \tau^*) > F(y_r \mid \overline{\tau}) \geq F(y_r \mid \tau_p^d)$

1. *Conditions for the case* $V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) > Max\left\{V(y_r \mid \tau_p^d), V(y_r \mid \overline{\tau}, \mu^h, 1)\right\}$.
Note first that $V(y_r \mid \overline{\tau}, \mu^h, 1) > V(y_r \mid \tau_p^d)$ *since the latter involves maximal transfers from rich to poor. Hence the case can be established if* $V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) > V(y_r \mid \overline{\tau}, \mu^h, 1)$. *We have* $V(y_r \mid \overline{\tau}, \mu^h, 1) = \frac{F(y_r|\overline{\tau})}{1-\delta}$ *and* $\overline{\tau}$ *satisfies* $\frac{(1-\overline{\tau})y_p + (\overline{\tau}-C(\overline{\tau}))y}{1-\delta} = \frac{y(1-\mu^h)n}{(1-\delta)m}$. *Now*

$$
\begin{aligned}
& V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) \\
&= \left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\left[F(y_r \mid \tau^*) + \delta\left[\rho\left(\mu^h\right)V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) + \rho\left(\mu^l\right)V(y_r \mid \tau^*, \mu^l, \rho(\mu^h))\right]\right] \\
&= \frac{\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\left[F(y_r \mid \tau^*) + \delta\left[\rho\left(\mu^l\right)V(y_r \mid \tau^*, \mu^l, \rho(\mu^h))\right]\right]}{1-\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\delta\rho\left(\mu^h\right)}
\end{aligned}
$$

and similarly

$$
\begin{aligned}
V(y_r \mid \tau^*, \mu^l, \rho(\mu^h)) &= \frac{\left(1-\rho(s^h \mid \mu^l)^{\bar{i}-1}\right)\left[F(y_r \mid \tau^*) + \delta\left[\rho\left(\mu^h\right)V(y_r \mid \tau^*, \mu^h, \rho(\mu^h))\right]\right]}{1-\left(1-\rho(s^h \mid \mu^l)^{\bar{i}-1}\right)\delta\rho\left(\mu^l\right)} \\
&= \frac{\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\left[F(y_r \mid \tau^*) + \delta\left[\rho\left(\mu^l\right)\frac{\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\left[F(y_r|\tau^*) + \delta\left[\rho\left(\mu^h\right)V(y_r|\tau^*,\mu^h,\rho(\mu^h))\right]\right]}{1-\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^l)}\right]\right]}{1-\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\delta\rho\left(\mu^h\right)}
\end{aligned}
$$

substituting in and rearranging gives

$$
\begin{aligned}
& V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) \\
&= \left(\frac{\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\left[1+\delta\left[\rho\left(\mu^l\right)\frac{\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)}{1-\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^l)}\right]\right]}{1-\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\delta\rho\left(\mu^h\right)-\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\delta\left[\rho\left(\mu^l\right)\frac{\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^h)}{1-\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^l)}\right]}\right)F(y_r \mid \tau^*)
\end{aligned}
$$

Hence since $F(y_r \mid \tau^*) > F(y_r \mid \overline{\tau})$ *the condition holds if*

$$
\left(\frac{\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\left[1+\delta\left[\rho\left(\mu^l\right)\frac{\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)}{1-\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^l)}\right]\right]}{1-\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\delta\rho\left(\mu^h\right)-\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\delta\left[\rho\left(\mu^l\right)\frac{\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^h)}{1-\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^l)}\right]}\right) \rightarrow \frac{1}{1-\delta}
$$

which is clearly satisfied if $\bar{i} \to \infty$. *To show this is possible take the"political protest" and "cascade conditions".*

$$\rho^* = \frac{\frac{F(y_p|\tau_r)}{V(y_p|0,\mu^h)} + \delta\rho\left(\mu^h\right)\rho(s^h \mid \mu^h)^{\bar{i}-1}}{1-\delta\left[\rho\left(\mu^h\right)\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right) + \rho\left(\mu^l\right)\left(1-\rho(s^h \mid \mu^l)^{\bar{i}-1}\right)\right]}$$

and

$$\rho^* = \frac{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)}{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right) + \left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)^{\bar{i}-1}}$$

equate them to give

$$\frac{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right)}{\left(\frac{\rho(\mu^h)}{\rho(\mu^l)}\frac{\rho(s^l|\mu^h)}{\rho(s^l|\mu^l)}\right) + \left(\frac{\rho(s^h|\mu^l)}{\rho(s^h|\mu^h)}\right)^{\bar{i}-1}} = \frac{\frac{F(y_p|\tau_r)}{V(y_p|0,\mu^h)} + \delta\rho\left(\mu^h\right)\rho(s^h \mid \mu^h)^{\bar{i}-1}}{1-\delta\left[\rho\left(\mu^h\right)\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right) + \rho\left(\mu^l\right)\left(1-\rho(s^h \mid \mu^l)^{\bar{i}-1}\right)\right]}$$

Now let $\frac{F(y_p|\tau_r)}{1-\delta} = V(y_p \mid 0, \mu^h)$ *and it can be verifies that the solution to the condition is* $\bar{i} = \infty$.

2. *Conditions for the case*$V(y_r \mid \overline{\tau}, \mu^h, 1) > Max\left\{V(y_r \mid \tau_p^d), V(y_r \mid \tau^*, \mu^h, \rho(\mu^h))\right\}$ ■
   We have

$$V(y_r \mid \tau^*, \mu^h, \rho(\mu^h))$$
$$= \left(\frac{\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\left[1+\delta\left[\rho\left(\mu^l\right)\frac{\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)}{1-\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^l)}\right]\right]}{1-\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\delta\rho\left(\mu^h\right)-\left(1-\rho(s^h \mid \mu^h)^{\bar{i}-1}\right)\delta\left[\rho\left(\mu^l\right)\frac{\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^h)}{1-\left(1-\rho(s^h|\mu^l)^{\bar{i}-1}\right)\delta\rho(\mu^l)}\right]}\right)F(y_r \mid \tau^*)$$

Clearly if $\rho(s^h \mid \mu^h) \to 1 \Rightarrow V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) \to 0$, *now* $V(y_r \mid \overline{\tau}, \mu^h, 1) \geq V(y_r \mid \tau_p^d)$ *since* τ_p^d *involve the maximal transfer from rich to poor. Hence if* $V(y_r \mid \overline{\tau}, \mu^h, 1) > 0$ *the result follows. We have* $V(y_r \mid \overline{\tau}, \mu^h, 1) = \frac{F(y_r|\overline{\tau})}{1-\delta}$ *and* $\overline{\tau}$ *satisfies*$\frac{F(y_p|\overline{\tau})}{1-\delta} = \frac{(1-\overline{\tau})y_p+(\overline{\tau}-C(\overline{\tau}))y}{1-\delta} = \frac{y(1-\mu^h)n}{(1-\delta)m} > 0$. *Now* $y_r > y_p \Rightarrow \frac{(1-\overline{\tau})y_r+(\overline{\tau}-C(\overline{\tau}))y}{1-\delta} > \frac{(1-\overline{\tau})y_p+(\overline{\tau}-C(\overline{\tau}))y}{1-\delta}$ *and the result follows.*

3. *Conditions for the case* $V(y_r \mid \tau_p^d) > Max\left\{V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)), V(y_r \mid \overline{\tau}, \mu^h, 1)\right\}$

Again let $\rho(s^h \mid \mu^h) \to 1 \Rightarrow V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) \to 0.\rho(s^h \mid \mu^h) \to 1 \Rightarrow V(y_r \mid \tau^*, \mu^h, \rho(\mu^h)) \to 0$ *Now note that* $V(y_r \mid \tau_p^d) = \frac{(1-\tau_p^d)y_r+\left(\tau_p^d-C(\tau_p^d)\right)y}{1-\delta}$ *and that* $V(y_p \mid \tau_p^d) = \frac{(1-\tau_p^d)y_p+\left(\tau_p^d-C(\tau_p^d)\right)y}{1-\delta}$ *now in democracy the poor set taxes to maximize* $V(y_p \mid \tau_p^d)$ *and note that evaluated at* $\tau = 0$ *we have* $V(y_p \mid 0) = \frac{y_p}{1-\delta} > 0$ *hence* $V(y_p \mid \tau_p^d) > V(y_p \mid 0) > 0$, *now* $y_r > y_p \Rightarrow \frac{(1-\tau_p^d)y_r+\left(\tau_p^d-C(\tau_p^d)\right)y}{1-\delta} > \frac{(1-\tau_p^d)y_p+\left(\tau_p^d-C(\tau_p^d)\right)y}{1-\delta}$ *so* $V(y_p \mid \tau_p^d) > V(y_r \mid \tau^*, \mu^h, \rho(\mu^h))$. *Finally suppose* $\frac{(1-\overline{\tau})y_p+(\overline{\tau}-C(\overline{\tau}))y}{1-\delta} < \frac{y(1-\mu^h)n}{(1-\delta)m}$ *then* $\overline{\tau}$ *cannot prevent rebellion and democracy must occur.*

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